suggested and the methods proposed, at certain periods of the year over the area prescribed, also biological plankton investigations similarly. What extra expense this will be to the Board it is not for me to say ; but with its staff and knowledge of the methods to be employed, the experience and equipment it has at its command, this will not be anything very great. There is no necessity here for co-ordinating, first of all, the work that might be done at St. Andrews, Millport, and Granton. These places will carry on their own work in their own way, because biological research must always be acceptable.   But, if the Fishery Board should desire any special work to be done at those stations, it has the staff, the knowledge of ways and means, and the funds at its disposal, and the work will be done.

England, unfortunately, is not prepared to the same extent. It has no central body whose knowledge and experience of fishery work in this and other countries could command the co-operation of the different stations.   It is doubtful also whether the biologists in England have worked on the methods suggested by the Congress.   If so, they have not yet published any results.   They are so far removed, further, from the centre for work, viz., the North Sea, that their work is formed on a different plan ; they have not the same aims, and they do not look at fishery problems as the biologists along the coasts of the North Sea do.   And it is a curious comment on this condition of England, that on its East Coast—from which as much fishing is carried on, and where the value of the fisheries is as great, as in all those of the other countries round the North Sea combined —it is curious that there is no station there which can adequately take up the work proposed, and that a great part of this coast is ascribed to Holland as within its area of investigation.   All this is said without intending any disrespect whatsoever to Mr. Allen, but it comes to one's mind in reading over his proposals.

The co-operation of the marine stations in England would not remedy this.   "A central bureau" for England alone would require to be established, with experienced trained men at its head. This would take much time and money, and when Great Britain has been offered a "central bureau" of more power and value at a less cost, there can be little doubt for which the Government will decide.

Without intruding further upon your space by entering into the advantages of the organisation proposed by the Congress, and of co-operation with foreign countries, let me, in conclusion, express my earnest desire to do justice to both sides. If Prof. Herdman can prescribe a better programme of work, if Mr. Allen can show a better organisation, then let us have them by all means.   The British Government will then have two definite schemes to consider, and if it finds it cannot decide between the two, then let us have two definite rival organisations, each doing its best with the means at its disposal to add to the knowledge and power of our country.   Here we should be at one, and rivalry will not be tinged with envy or bitterness, but stimulate to greater exertions, and breed that respect and community of sentiment which springs from a common ideal and hard work well done.   H. M. KYLE.

Naples, December 8.

Supposed Daylight Leonids.

THE interesting details referred to by Dr. W. J. S. Lockyer (NATURE, December 7) of a shower of Leonids having been witnessed by Miss Jeans and others at Swindon, and by Mr. E. Shaw at Aveley, in Essex, on the afternoon of November 15 last are corroborated by several other descriptions of a similar nature which recently appeared in the newspapers.   One of these referring to a later date, was published in the *Liverpool Echo* of November 21, and runs as follows :—

"SIR,—Not having seen any account in the papers concerning the arrival of the meteoric showers, I beg to state that I saw them on Thursday afternoon, the 16th inst.   I first noticed them at 12.15 ; they were shooting in all directions and kept on until about 4 o'clock.   Then on Friday, the 17th, I again saw them at the same time.   I called the attention of several people, with the result that they could also see them.   Owing to the bright sky, one had to stare for a few seconds before perceiving the stars, as they were very dazzling to the eyes.

"Yours, &c.,
"Liverpool, November 20."   "MIMA ARDEN.

I need not quote any further descriptions, for there is not the slightest doubt that the objects were illusory and had nothing

whatever to do with the November meteors.   On November 15 the radiant of the Leonids sets at 2.30 p.m., so that the observations of Mr. E. Shaw (quoted by Dr. Lockyer), Miss Arden and some others are entirely put out of court, for we cannot have a shower of Leonids with the radiant below the horizon.

The objects seen must have been purely imaginary, and they may be easily produced by bending the neck and gazing intently for a few minutes at a bright sky.   I have observed many of these spectral meteor showers on occasions when I have been looking for Venus or some other object in bright daylight.

It is astonishing that if one calls the attention of people to imaginary phenomena of this kind and asks them to look, they will, in ninety-nine cases out of one hundred, see the same thing and encourage similarly mistaken ideas !   Yet if we observe an unequivocal object, it is often very difficult to make others perceive it and comprehend its character and the nature of the observation.   Fictitious objects are in point of fact often seen more readily and apparently under more convincing aspects than real ones, but this applies usually to inexperienced observers.

In addition to the two reports of the recent shower of Andromedids mentioned in the last number of NATURE, there is a third from Austria (*Daily Chronicle*, November 25).   It appears that the astronomers of the Vienna observatory, watching the sky "from the beginning of evening up to moonrise, saw sixty-seven shooting stars, mostly from Andromeda.   A magnificent fireball was also observed shining in the constellation.   Twelve photographs were taken."   W. F. DENNING.

Bristol, December 8.

Birds Capturing Butterflies.

REFERRING to the letters on this subject in your papers of September 28 and November 16, I can certify to the fact of robins chasing and catching large white butterflies on the wing and swallowing them whole.   In June we had ten robins coming freely to the hand for food, and thus had frequent opportunities of observing them daily.   My gardener and his son have witnessed the same habit of the robins.   HOWARD FOX.

Rosehill, Falmouth, December 7.

VALVE MOTIONS OF ENGINES.

ENGINEERS want a diagram which for any position of the main crank of a steam engine (the angle θ which it makes with the inner dead point being given) shows at once, with sufficient accuracy for practical purposes, the position of the piston in its stroke, and the distance of the valve from its mid position.   This is a mathematical problem.   Men who are cunning in geometrical constructions ought to help the engineers ; but hitherto they have not done so.   In the hope of enlisting their services I venture to put before the readers of NATURE the only easy construction with which I am acquainted.   It has never before been published, except to his students, by the inventor, Mr. J. Harrison, of the Royal College of Science.   Until I became acquainted with this method, I used a very laborious method of working, which necessitated the drawing of sine curves of different periods as described in my book on "Steam."

It will save trouble in expressing my meaning if I assume a uniform rotation of the crank.   If we assume that the motions of piston and valve are simple-harmonic, a construction is very easy.   When the valve is worked directly by an eccentric its motion is very nearly S.H., and in this case a construction, taking account of the shortness of the connecting rod, is easy.

But, as I have been trying to impress upon students for many years, when a valve is worked by any ordinary link motion or radial valve gear, the motion is not simple-harmonic ; there is a small octave or kick of twice the fundamental frequency, and if this is taken into account, as well as the fundamental S.H. motion, it will be found that higher harmonics are of very little importance.   Now in radial valve gears it is not at all

difficult to write down the values of the terms a, a, b, β of the following expression from mere inspection of the gear. In link motions it is more difficult at present, but we are already seeing our way to easy rules. Here, then, is the problem which Mr. Harrison has solved :—

Given the ratio of length of connecting rod to that of the crank. Given that the distance of the valve to the right of its mid stroke (Fig. 1) is

$$y = c + a \sin(\theta + \alpha) + b \sin(2\theta + \beta),$$

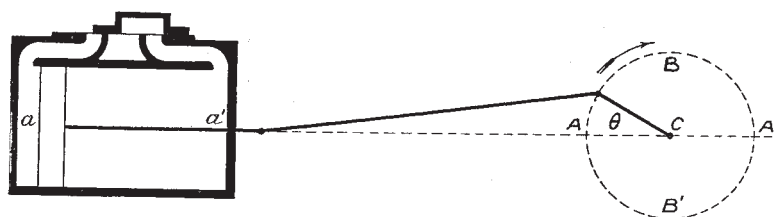b being small in comparison with a, show on a diagram the position of the piston and the value of y when θ has

FIG. 1.—A is called the inner dead point.   The motion from a to a' is called the *in* stroke.
A′ ,, outer ,, ,,   ,, ,, a' to a ,, *out* ,,

any value. Further, the laps XY and X′Y′ (Fig. 2) being given, show on the diagram the amounts of opening of the ports to steam, these being obtained by subtracting the laps from y or $-y$.

With centre C (Fig. 3) and radius CA or CA′ representing the crank, describe the crank circle ABA′B′. Draw BCB′ at right angles to ACA′. With centre on CA produced, and radius equal to length of connecting rod, describe the arc BOB′. Make angle $COC_1 = \beta - \alpha$ and $OC_1 = 2b$. We give the name "false centre" (relatively to both circles) to the point O.

IN STROKE.
PISTON MOVING TOWARDS CRANK.

PISTON MOVING AWAY FROM CRANK.
OUT STROKE.

FIG. 3.—Mr. Harrison's diagram showing positions of piston and valve when crank makes an angle θ with inner dead point. The valve displacement to right of mid position (Fig. 2) being y, where
$$y = c + a \sin(\theta + \alpha) + b \sin(2\theta + \beta).$$

With centre C_1 and radius a, describe the circle DQD′Q′. Draw DC_1D' making an angle with AA′ equal to α. Draw ST parallel to DD′ at a perpendicular distance from it equal to the lap XY of Fig. 2. Draw S′T′ also parallel to D′D at a perpendicular distance from it equal to the lap X′Y′ of Fig. 2.

Draw tangents at A, B, A′, B′. In the *in* stroke of the piston, when the crank moves from A to B to A′, let us show on EF the positions of the piston, and in the *out* stroke, when the crank moves from A′ to B′ to A, let us show on E′F′ the positions of the piston.

For any value of θ: Make AOK $= \theta$, project K vertically to P ; P shows the position of the piston, EP is its distance from the beginning of its stroke. OK cuts the valve circle in Q. The perpendicular distance QN of Q from DC_1D' is y, and the part of it QM is the opening of the left-hand port to steam. Similarly, in the *out* stroke, when the crank has passed through the angle AOK′ which is greater than 180° ; project K′ to P′ to get the piston position in the out stroke. Let OK′ cut the valve circle in Q′ ; then the perpendicular distance Q′N′ is the distance of the valve to the left of its mid position (Fig. 2), and Q′M′ is the opening of the right-hand port to steam.
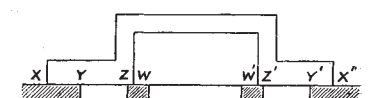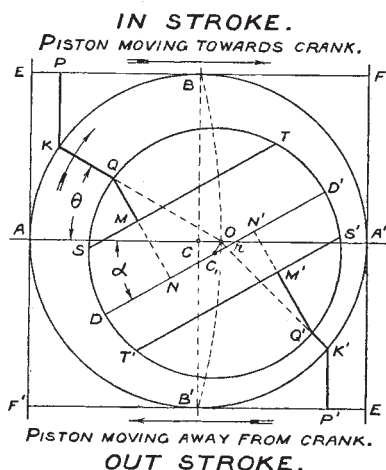

FIG. 2.—Valve shown in the middle of its stroke. X Y and x′ y′ are the *laps* (sometimes called the *steam laps*). z w and z′ w′ are the inside laps (sometimes called the *exhaust laps*).

It is easy to see how we get the openings of the ports to exhaust in exactly the same way. Lines joining O with S, T, S′, T′ show the angular positions of the crank when admission and cut off take place. In fact, we see that this diagram gives us the positions of the piston when admission, cut off, release and compression occur both in the *out* and *in* strokes. It gives us an easy way to study how changes in b and β enable us (even when the laps are equal) to balance, or even more than balance, the inequality of admission of steam on the two sides of the piston due to shortness of connecting rod.

It is easy to see how such a diagram may be modified for problems concerning cut off valves on the back of the main slide valve.

The same expedient of false centres may be used to show the velocity or acceleration of a slide.

In a modified diagram Mr. Harrison sometimes lets the two circles coincide, using two false centres.

The solution is a close approximation to the truth in all the usual cases, because b is always small in comparison with a.   JOHN PERRY.

INSECTS AS CARRIERS OF DISEASE.[1]

THE recent researches of bacteriologists into the *rôle* played by insects as carriers of infection, and the hunt after microbes to locate their natural habitat, is a necessary procedure before it becomes possible to enter on a scientific crusade against them. In those diseases which may be caused by infection carried by insects, it is a more hopeful task to deal with the insects which we can see, than to deal with the microbe which lurks unseen and unheeded. At the same time, it is an uncomfortable thought that insects which we have regarded as undesirable but harmless may be the cause of a serious illness.

The bacteriologist has now shown a fair-sized category of diseases to be caused by microbes, and having arrived so far the hygienist steps in and wants to know firstly, what is the habitat of these microbes outside the human or animal body if they have one, and secondly, by what means they are conveyed to the body from their resting-place outside or from one patient to another ?

1 "On the *Rôle* of Insects, Arachnids and Myriapods, as carriers in the spread of Bacterial and Parasitic Diseases of Man and Animals. A critical and historical study." By Dr. G. H. F. Nuttall (from the *Johns Hopkins Hospital Reports*, vol. viii.).